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US 4580458 A

US 4466304 A

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(54) Abstract Title

A drive transmission for a stern or outboard drive of a watercraft

(57) A stern/outboard drive unit, for a watercraft, comprises an intermediate drive shaft 8 mounted for axial translatable movement within an outer housing 1 and splined at its upper end for driven engagement with an input drive shaft 23 of the stern or outboard drive. The intermediate shaft 8 carries upper and lower gears 9, 10 that are rotatable relatively to the intermediate shaft 8 but can be coupled thereto by means of friction clutches recessed within the respective gears. Intermediate shaft 8 can be moved axially relatively to the housing 1 in each of two directions by means of a hydraulic piston and cylinder arrangement 26-33. A collar 15 fixed with respect to the intermediate drive shaft 8 is arranged to actuate the respective friction clutches in each direction of translatable motion whereby the intermediate shaft 8 can be coupled either to gear 9 or gear 10. The gear 10 is directly coupled to an output shaft and the gears 9, 10 are interconnected by an auxiliary gear train 4-6. Thus, axial translatable movement of the shaft 8 selects either a direct drive from the input shaft 23 to output gear 10 or provides a geared drive to the output shaft 23 via gears 9, 10 and the auxiliary gear train 4-6.

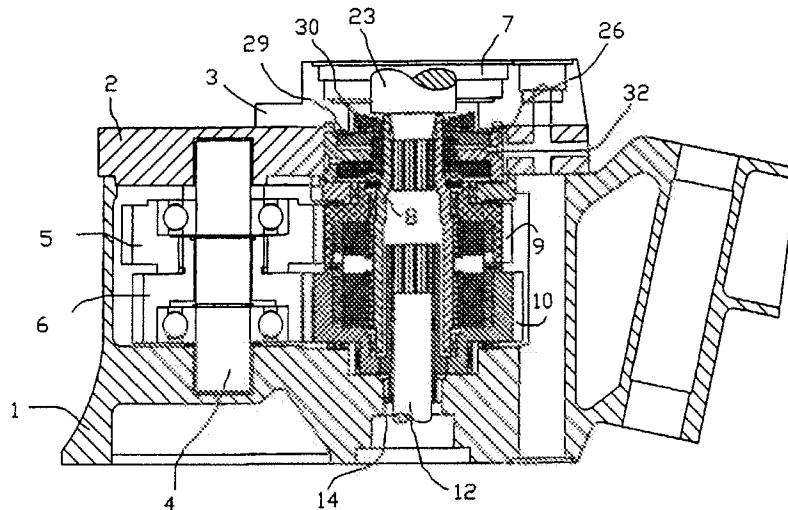


Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

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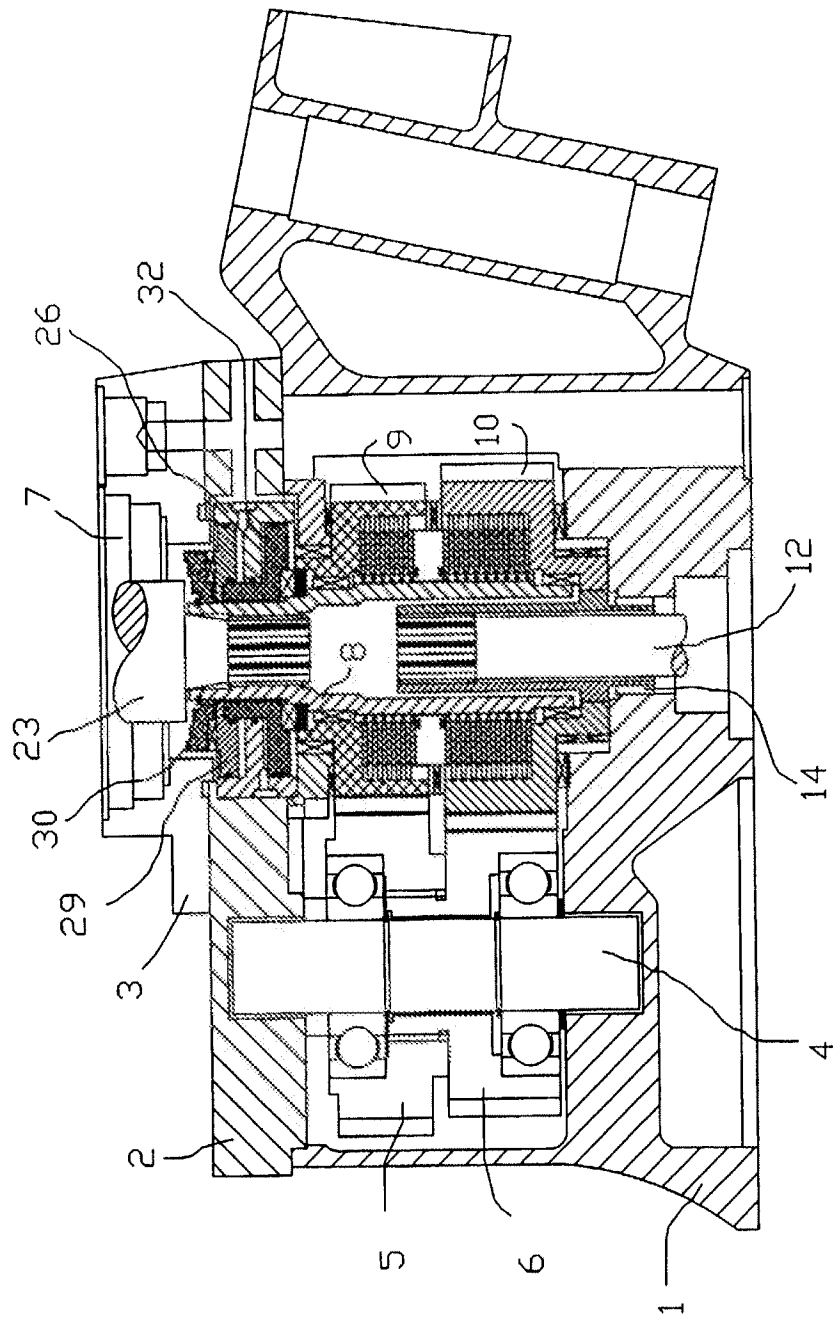


Fig. 1

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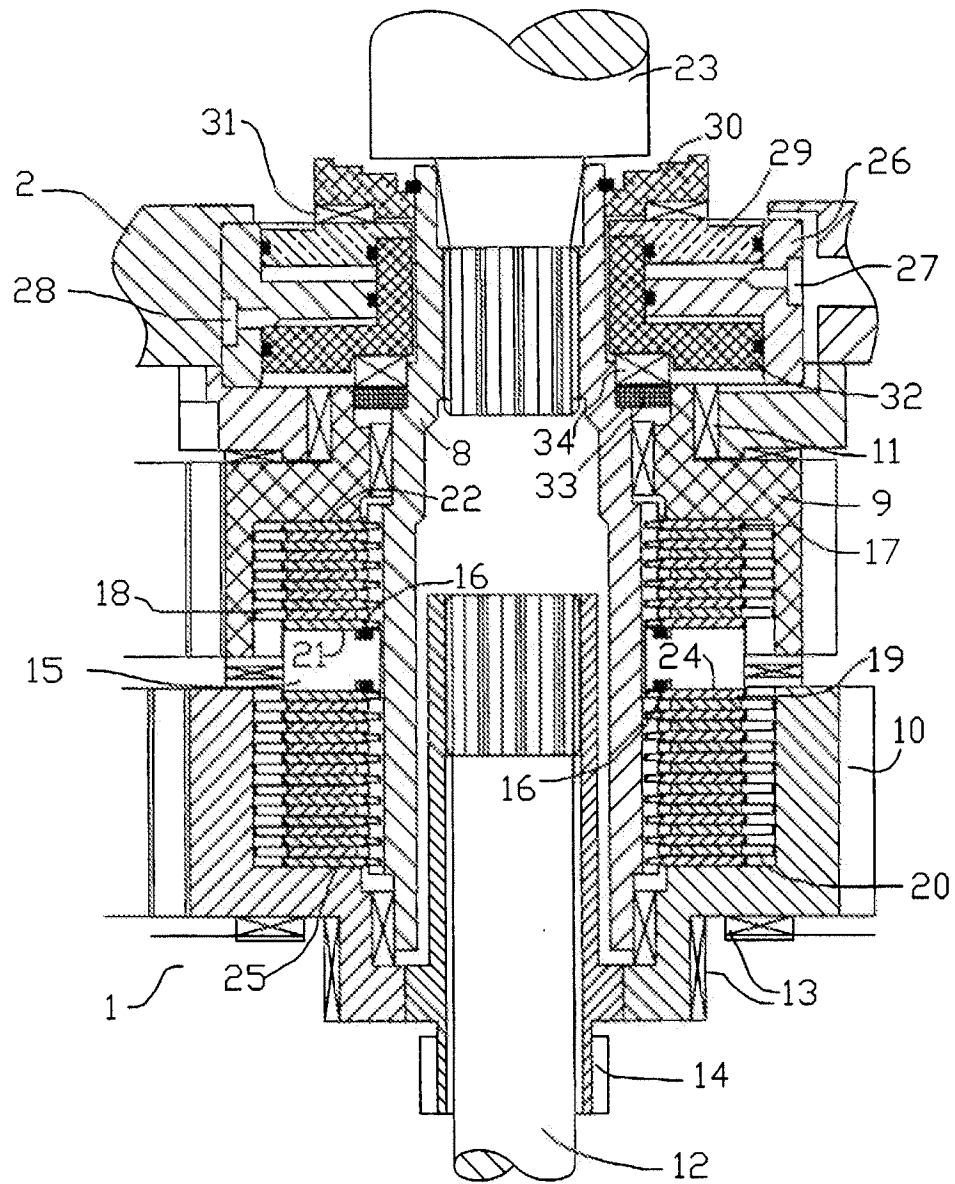


Fig. 2

DRIVE TRANSMISSION INCORPORATING A FRICTION CLUTCH

This invention concerns a drive transmission incorporating a friction clutch, and more especially a transmission for incorporation in an intermediate transmission unit to be provided in the drive leg of a stern drive or outboard drive of a watercraft.

In a conventional stern drive unit for a watercraft, there is provided between a drive shaft at the upper end of the stern drive and the output shaft for driving the propeller at the lower end of the stern drive, an intermediate unit providing a coupling between the drive shaft and the output shaft. The drive shaft and the output shaft are located in spaced relation on a common axis, and the purpose of the intermediate unit is normally to provide a direct coupling between the drive shaft and the output shaft. Such an intermediate unit that provides a direct coupling is of relatively limited vertical height. The present invention is based upon the premise that it would be possible to provide, as a retro-fit, an intermediate transmission unit replacing the standard intermediate unit of a stern drive and incorporating a gear box to enable the direct drive of the standard stern drive leg to be augmented by an optionally selectable geared drive to provide a step drive, that is to say either an overdrive or means of providing an alternative higher gear ratio.

The benefits of multiple gear ratios depend on whether a speed reducing or speed increasing ratio is installed. With a reduction ratio, low speed manoeuvrability is enhanced and acceleration on to the plane is improved. With an overdrive ratio, top end speed can be increased or cruising speed can be obtained using less engine revolutions. Both options will reduce fuel consumption, wear emissions and noise.

Thus, the invention is directed to solving the problem of incorporating a drive transmission for a gear box in an intermediate unit that can be retro-fitted to an existing stern drive or outboard drive mechanism.

Essentially, the problem to be solved by the invention is that of incorporating an appropriate drive mechanism in the very limited vertical height available in the intermediate unit of a stern drive, and, to the extent that the same problem may exist in other contexts, it will be appreciated that the arrangement according to the invention is not necessarily limited to use in the intermediate unit of a stern drive, but may have wider applications.

In accordance with the invention there is provided a drive transmission comprising an input shaft, an output drive element arranged on a common axis therewith, and a friction clutch means located between said input shaft and said output drive element, said input shaft and said output drive element being arranged for relative axial translatory movement whereby in respectively axially displaced positions the input drive shaft and the output drive element are respectively held against relative rotation via said friction clutch means and released to enable drive to be transmitted via an auxiliary gear box.

The arrangement in accordance with the invention takes advantage of the fact that in a conventional stern drive the input drive shaft of the intermediate unit is splined to a drive shaft transmitting power from the motor, so that translatory movement of the input drive shaft can be accommodated by the splined connection.

Advantageously, axial movement of the input drive shaft for actuation of the friction clutch is provided for by means of a hydraulically actuated piston arranged coaxially with the input drive shaft.

The output drive element preferably comprises an output drive gear for coupling to a drive shaft at the lower end of a stern drive leg, the output gear being axially recessed to accommodate the friction clutch.

In a preferred embodiment of the invention, the input drive shaft is arranged coaxially with input and output drive gears, both gears being recessed to accommodate friction

clutches, and the input drive shaft is arranged to be driven axially in each of two opposite directions, by respective hydraulic pistons, whereby, in each of said directions of axial movement, the drive shaft is caused to actuate a corresponding one of said friction clutches. A gear box incorporated in the intermediate unit of the drive leg may then be provided by means of a simple lay shaft carrying lay gears meshing with the input and output gears respectively.

The invention is illustrated by way of example in the accompanying drawings in which:

Fig.1 is a sectional elevation of one embodiment of an intermediate unit in accordance with the invention, for incorporation in a stern drive, and

Fig.2 is a fragmentary view corresponding to Fig. 1 illustrating the clutch mechanism of the intermediate unit in greater detail.

Referring to the drawings, an intermediate unit for a stern drive comprises an outer housing 1 shaped to correspond with a standard intermediate unit for a conventional stern drive for which the intermediate unit according to the invention is to be a replacement fit. The housing 1 is closed at the upper end by means of a first cover plate 2 and a second sub-cover plate 3.

A lay shaft 4 is rotatably mounted in bearings respectively provided in the housing 1 and the cover plate 2 and carries, fixed with respect thereto, a first lay gear 5 of larger diameter and a second lay gear 6 of smaller diameter.

The sub-cover 3 provides an opening 7 allowing access to the upper end of a clutch drive shaft 8 that extends vertically within the housing 1 and is arranged coaxially with an input gear 9 meshing with the lay gear 5 and an output gear 10 meshing with the lay gear 6.

The input gear 9 and output gear 10 are mounted for rotation within the housing 1 via appropriate bearings indicated diagrammatically at 11.

The clutch drive shaft 8 is hollow, being splined internally at the upper end to receive a drive shaft from the drive head of a stern drive unit, and being open at the lower end to accommodate a drive shaft 12 that extends from the lower unit (not shown) of the stern drive, in known manner. The clutch drive shaft 8 is located within the input gear 9 and output gear 10 by means of bearings indicated diagrammatically at 13, the bearings 13 being such as to allow axial sliding movement of the shaft 8 relatively to the gears 9 and 10.

The lower end of the output gear 10 is splined to a hollow coupling shaft 14 (omitted from Fig. 2 for clarity) the coupling shaft extending coaxially with the output drive shaft 12 and being splined thereto in order to provide a direct connection between the output gear 10 and the drive shaft 12.

Referring now to Fig. 2, it will be seen that the clutch drive shaft 8 carries a regularly extending collar 15 that is located upon an external spline of the clutch drive shaft 8 so that it is rotationally fixed with respect thereto, and is held in place against axial movement with respect to the clutch drive shaft 8 by means of circlips 16 that are recessed in the collar 15 and engaged within radial grooves in the splines of the clutch drive shaft 8.

The external splines of the clutch drive shaft 8 also engage within a series of friction clutch plates 17 that are located within an axial recess of the input gear 9 and inter-engage with friction clutch plates 18 that respectively engage within an internal spline on the input gear 9.

Likewise, within the output gear 10 are located a further series of clutch plates 19 splined to the clutch shaft 8 and clutch plates 20 splined within the output gear 10.

It will thus be seen that upon axial movement of the clutch drive shaft 8 in the upward direction the clutch plates 17 and 18 are compressed between an upper face 21 of

collar 15 and a lower face 22 of input gear 9 so that the clutch drive shaft 8 becomes fixed with respect to the gear 9. The output gear 10 can then rotate freely, and thus a reduction drive is effected between the input gear 9, the lay gears 5 and 6 and the output gear 10. A low speed drive is thus provided between an input drive shaft 23 splined to the clutch drive shaft 8 and the output drive shaft 12 that is coupled to the gear 10 via the coupling shaft 14.

If, on the other hand, the clutch drive shaft 8 is moved axially downwards, the clutch plates 19 and 20 likewise become compressed between a lower face 24 of the collar 15 and an upper face 25 of the gear 10 whereby the clutch drive shaft 8 is directly coupled to the output gear 10 and the input drive shaft 23 is directly coupled to the output drive shaft 12 as in the conventional stern drive unit.

The aforesaid axial movement of the clutch drive shaft 8 is provided by means of a hydraulic piston and cylinder unit comprising a cylinder body 26 fixed between the housing 1 and the cover plate 2 and provided with hydraulic unions 27 and 28 incorporated within a conventional hydraulic circuit that is not further illustrated. The cylinder body 26 incorporates an upper piston 29 that can engage a thrust collar 30 of the clutch drive shaft 8 via a thrust face 31. The cylinder 26 also incorporates a lower piston 32 that can engage a thrust collar 33 of the clutch drive shaft 8 via a thrust face 34. Thus, hydraulic actuation of the clutch drive shaft 8 in each of two axial directions can be effected in a simple manner by means of a relatively compact mechanism.

The arrangement in accordance with the above described embodiment of the invention thus provides an extremely compact and simple hydraulically actuatable two speed drive that can be accommodated in an intermediate unit of a stern drive that is intended as a retrofit for a conventional non-geared unit.

It will be appreciated that various alterations and modifications may be made to the arrangement described above without departing from the scope of the invention. Thus, although the illustrated arrangement shows a clutch drive shaft 8 that is

arranged to actuate each of two friction clutches by means of a double acting mechanism, it would be feasible to provide only a single acting mechanism with a single friction clutch for coupling the clutch drive shaft to the output gear 10, the input gear 9 being fixed with respect to the clutch drive shaft 8 and a further clutch arrangement being provided in association with the lay shaft 4. Such a construction might be desirable for the transmission of powers higher than that capable of being accommodated by the illustrated arrangement.

CLAIMS:

1. A drive transmission comprising an input shaft, an output drive element arranged on a common axis therewith, and a friction clutch means located between said input shaft and said output drive element, said input shaft and said output drive element being arranged for relative axial translatory movement whereby in respectively axially displaced positions the input drive shaft and the output drive element are respectively held against relative rotation via said friction clutch means and released to enable drive to be transmitted via an auxiliary gear box.
2. A drive transmission according to Claim 1 wherein axial movement of the input drive shaft for actuation of the friction clutch is provided for by means of a hydraulically actuated piston arranged coaxially with the input drive shaft.
3. A drive transmission according to Claim 1 or 2 wherein the output drive element comprises an output drive gear adapted for coupling to a drive shaft at the lower end of a stern drive leg.
4. A drive transmission according to Claim 3, wherein the output drive gear is axially recessed to accommodate the friction clutch.
5. A drive transmission according to any one of Claims 1 to 4, wherein the input drive shaft is arranged coaxially with input and output drive gears, both gears being recessed to accommodate friction clutches, and the input drive shaft is arranged to be driven axially in each of two opposite directions, by respective hydraulic pistons, whereby, in each of said directions of axial movement, the drive shaft is caused to actuate a corresponding one of said friction clutches.
6. A drive transmission according to Claim 5, wherein the elements of the drive transmission are incorporated in an intermediate unit adapted to form part of the drive leg of a stern drive, and wherein said intermediate unit further incorporates a gear box comprising a lay shaft carrying lay gears meshing with the input and output gears respectively.

7. A drive transmission according to any one of Claims 1 to 6, wherein the said input shaft is provided with a splined connection for coupling with a drive shaft transmitting power from a motor of a stern drive, whereby translatory movement of the input drive shaft can be accommodated by the splined connection.
8. A drive transmission substantially as described herein with reference to Figures 1 and 2 of the accompanying drawings.



Application No: GB 0024320.4
Claims searched: 1 to 8

Examiner: Mike McKinney
Date of search: 29 August 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F2D (DTG).

Int Cl (Ed.7): F16H 3/08, 3/091, 3/093, 3/097.

Other: ONLINE: WPI; EPODOC; JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 4580458 (GOETT et al)	1
X	US 4466304 (GOETT et al) see fig 1, especially, axially moveable input shaft 1 coupling 3, 4, 12 which, when engaged, holds input shaft 1 and output shaft 2 against relative rotation and when released enables drive to be transmitted via, for example, gears 23, 24, 25 etc.	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.